KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI II : 2025/2026

DET10103 : ELECTRICAL CIRCUITS 1

TARIKH : 14 MEI 2026
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas soalan ini mengandungi **SEMBILAN (9)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (1 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 80 MARKS

BAHAGIAN A : 80 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Identify the **TWO (2)** main effects of electric current and its practical examples.
*Kenal pasti **DUA (2)** kesan utama arus elektrik dan contoh praktikalnya.*

[4 marks]
[*4 markah*]

CLO1 (b) Based on the circuit in Figure A1(b), three resistors are connected in series-parallel, $R_a = 20\Omega$, $R_1 = 30\Omega$ and $R_2 = 50\Omega$. The power supply is a 20V battery. Simplify the circuit to obtain the total resistance (R_T), the total current (I_a) and the current flows through the resistor R_1.
Berdasarkan litar pada Rajah A1(b), tiga perintang disambung secara siri-selari, $R_a=20\Omega$, $R_1=30\Omega$ dan $R_2=50\Omega$. Bekalan voltan ialah bateri 20V. Permudahkan litar tersebut untuk mendapatkan jumlah rintangan (R_T), jumlah arus (I_a) dan arus yang mengalir melalui perintang R_1.

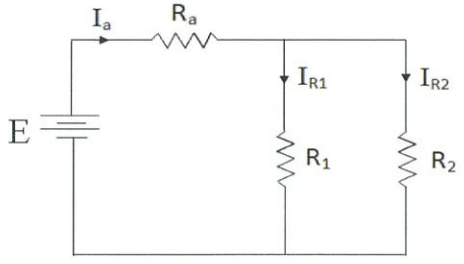


Figure A1(b) / *Rajah A1(b)*

[6 marks]
[*6 markah*]

CLO1 (c) By referring to Figure A1(c), calculate the total resistance at XY terminal, the I_a current and I_b current using Current Divider Rule (CDR). Given the voltage supply is 60V and the total current I_T is 1.5A.

Dengan merujuk kepada Rajah A1(c), kirakan jumlah rintangan pada terminal XY, arus I_a dan arus I_b dengan menggunakan kaedah Hukum Pembahagi Arus (CDR). Diberi bekalan voltan, E ialah 60V dan jumlah arus, I_T adalah 1.5A.

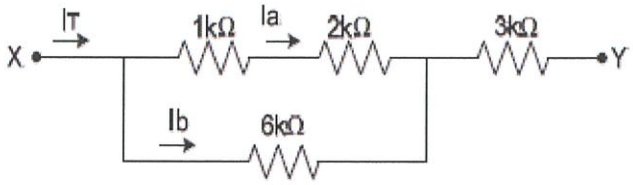


Figure A1(c) / *Rajah A1(c)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Label the Norton equivalent circuit shown in Figure A2(a) with the correct circuit elements.

Labelkan litar setara Norton pada Rajah A2(a) dengan unsur yang sesuai.

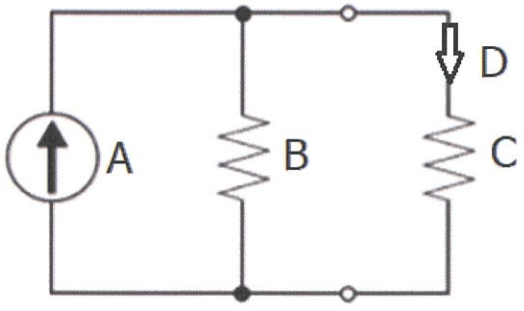


Figure A2(a) / *Rajah A2(a)*

[4 marks]

[*4 markah*]

CLO1 (b) Four 100μF capacitors are connected in a circuit. Choose either a series or parallel connection that produces the lower total capacitance by calculating the total capacitance of both connections using the appropriate formula.

Empat kapasitor 100μF disambungkan dalam satu litar. Pilih sama ada sambungan siri atau selari yang menghasilkan jumlah kapasitan yang lebih rendah dengan mengira jumlah kapasitan kedua-dua sambungan menggunakan formula yang sesuai.

[6 marks]

[*6 markah*]

CLO1 (c) Figure A2(c) shows a circuit consisting of a 100Ω resistor and a 20uF capacitor. If the switch (SW) is connected to node a, calculate the time constant of the circuit, the maximum voltage of the capacitor, the instantaneous capacitor voltage when t = 3ms and the maximum energy stored by the capacitor.

Rajah A2(c) menunjukkan satu litar yang terdiri daripada perintang 100Ω dan kapasitor 20uF. Jika suis (SW) disambungkan ke nod a, kirakan pemalar masa litar, voltan maksimum kapasitor, voltan kapasitor serta-merta apabila t = 3ms dan tenaga maksimum yang disimpan oleh kapasitor.

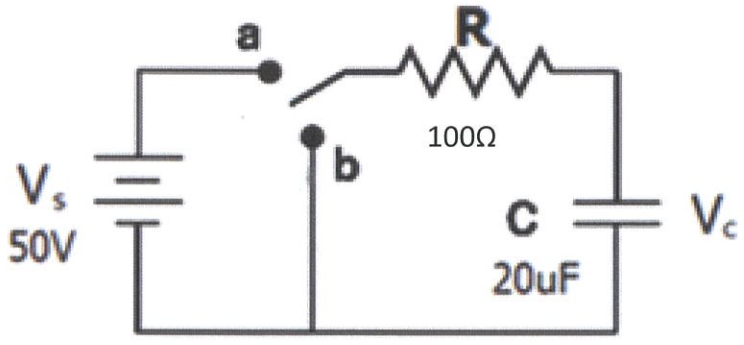


Figure A2(c) / *Rajah A2(c)*

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Identify the magnetic field direction using a compass and the Right-Hand Rule.
Kenal pasti arah medan magnet menggunakan kompas dan Peraturan Tangan Kanan.

[4 marks]
[*4 markah*]

CLO1 (b) By referring to Figure A3(b), simplify the circuit to obtain the total inductance (L_T) at terminal A-B.
Dengan merujuk kepada Rajah A3(b), permudahkan litar untuk mendapatkan jumlah kearuhan (L_T) pada terminal A-B.

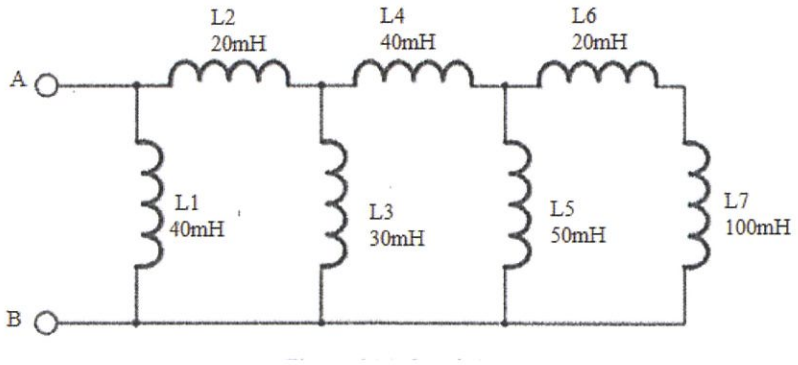


Figure A3(b) / *Rajah A3(b)*

[6 marks]
[*6 markah*]

CLO1 (c) Figure A3(c) shows a series RL circuit consisting of a 100Ω resistor and a 200mH inductor. If the switch (SW) is connected to node b, calculate the time constant of the circuit, the maximum current rises in the inductor, the inductor current when t = 1ms and the maximum energy stored by the inductor.

Rajah A3(c) menunjukkan satu litar siri RL yang terdiri daripada perintang 100Ω dan peraruh 200mH. Jika suis (SW) ditukar bersambung kepada nod b, kirakan pemalar masa litar tersebut, nilai arus maksimum yang mengalir dalam peraruh, nilai arus dalam peraruh pada t=1ms dan tenaga maksimum yang disimpan oleh peraruh.

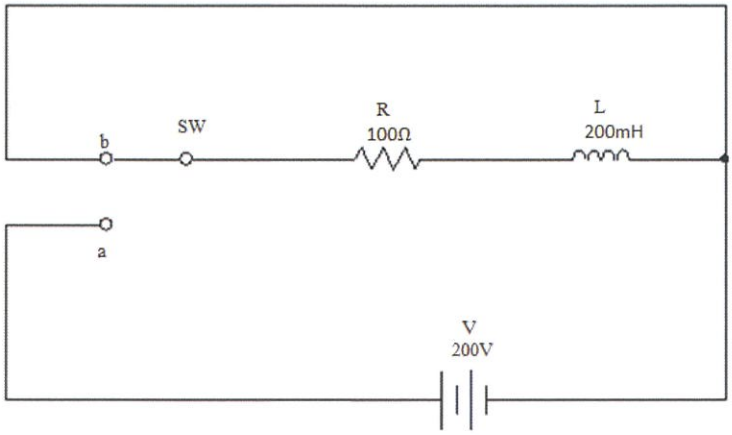


Figure A3(c) / *Rajah A3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) State **FOUR (4)** characteristics of magnetic flux lines.

*Nyatakan **EMPAT (4)** ciri garis fluks magnet.*

[4 marks]

[*4 markah*]

CLO1 (b) A coil is having 450 turns with 2A current. If the length of magnetic circuit is 50m and the flux is 0.5 Webers. Express the value of magnetomotive force (Fm), magnetic field strength (H) and reluctance (S).

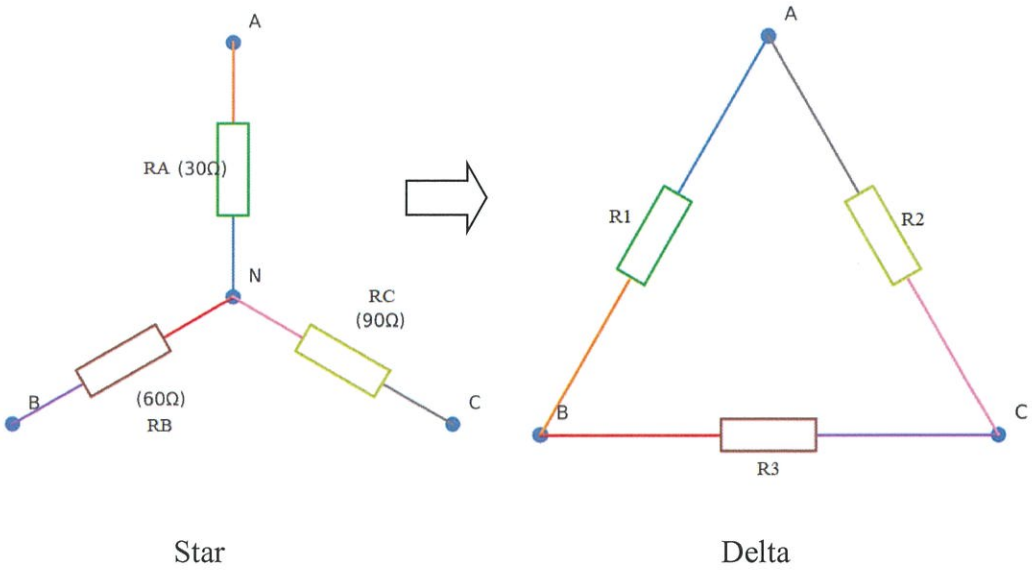
Satu gegelung mempunyai 450 lilitan dengan arus 2A. Jika Panjang litar magnetic ialah 50m, nyatakan nilai bagi daya gerak magnet (Fm), kekuatan medan magnet (H) dan regangan (S).

[6 marks]

[*6 markah*]

CLO1 (c) Figure A4(c) shows a Star (Y) to Delta (Δ) connection consisting of three resistors (RA = 30 Ω, RB = 60 Ω and RC = 90 Ω). If the connection is transformed into a Delta connection, calculate the values of resistors R1, R2 and R3.

Rajah A4(c) di bawah menunjukkan satu sambungan Star (Y) kepada Delta (Δ) yang terdiri daripada tiga perintang (RA = 30 Ω, RB = 60 Ω dan RC = 90 Ω). Jika sambungan tersebut ditukarkan kepada sambungan Delta, kirakan nilai perintang R1, R2 dan R3.



Star Delta

Figure A4(c) / *Rajah A4(c)*

[10 marks]

[*10 markah*]

SECTION B : 20 MARKS

BAHAGIAN B : 20 MARKAH

INSTRUCTION:

This section consists of **ONE (1)** essay questions. Answer the questions.

ARAHAN:

*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO1 Norton's Theorem is one of the methods that can be used to solve DC circuits. Based on Figure B1, calculate the current flow through the 60Ω resistor using the Norton's Theorem and then convert the Norton's Equivalent circuit to the Thevenin's Equivalent Circuit.

Teorem Norton adalah salah satu kaedah yang boleh digunakan untuk meyelesaikan litar DC. Berdasarkan pada Rajah B1, kirakan arus yang mengalir melalui perintang 60Ω dengan menggunakan Teorem Norton dan kemudian tukarkan litar Setara Norton kepada litar Setara Thevenin.

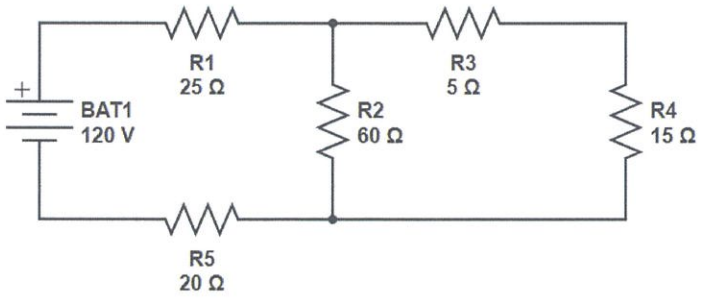


Figure B1 / *Rajah B1*

[20 marks]

[*20 markah*]

SOALAN TAMAT

APPENDIX – Related Formulas

$$Q = It$$

$$R = \frac{\rho l}{A}$$

$$V = IR$$

$$P = IV = I^2R$$

$$W = Pt$$

$$C = \frac{Q}{V}$$

$$R_T = R_1 + R_2 + \cdots + R_n$$

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}}$$

$$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$I_{R1} = \frac{R_2}{R_1 + R_2} \times I$$

$$I_{R1} = \frac{\frac{1}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}} \times I$$

$$V_{R1} = \frac{R_1}{R_1 + R_2 + \cdots + R_n} \times E$$

$$R_N = R_{TH}$$

$$I_L = \frac{V_{TH}}{R_L + R_{TH}}$$

$$I_N = \frac{V_{TH}}{R_{TH}}$$

$$V_{TH} = I_N \times R_N$$

$$I_L = \frac{R_N}{R_N + R_L} \times I_N$$

$$E = \frac{V}{d}$$

$$C = \frac{\varepsilon_r \varepsilon_0 A}{d}$$

$$D = \frac{Q}{A}$$

$$\mu = \mu_0 \mu_r$$

$$\varepsilon = \varepsilon_0 \varepsilon_r = \frac{D}{E}$$

$$\mu_0 = 4\pi \times 10^{-7}$$

$$\varepsilon_0 = 8.854 \times 10^{-12}$$

$$\tau = RC$$

$$E_C = \frac{1}{2} CV^2$$

$$\tau = \frac{L}{R}$$

APPENDIX – Related Formulas

$$E_L = \frac{1}{2}LI^2$$

$$v_C(t) = V_{max}(1 - e^{-t/\tau})$$

$$v_C(t) = V_{max}(e^{-t/\tau})$$

$$i_C(t) = I_{max}\ (e^{-t/\tau})$$

$$i_L(t) = I_{max}(1 - e^{-t/\tau})$$

$$i_C(t) = -I_{max}\ (e^{-t/\tau})$$

$$i_L(t) = I_{max}(e^{-t/\tau})$$

$$E = -L\frac{dI}{dt}$$

$$E = -N\frac{d\phi}{dt}$$

$$L = \frac{N\phi}{I}$$

$$H = \frac{F_m}{l}$$

$$L = \frac{N^2\mu_r\mu_0 A}{l}$$

$$F_m = IN$$

$$\mu = \frac{B}{H}$$

$$B = \frac{\phi}{A}$$

$$S = \frac{F_m}{\phi}$$

$$S = \frac{l}{\mu_0\mu_r A}$$

$$R_1 = \frac{R_A R_B + R_B R_C + R_A R_C}{R_C}$$

$$R_A = \frac{R_1 R_3}{R_1 + R_2 + R_3}$$

$$R_2 = \frac{R_A R_B + R_B R_C + R_A R_C}{R_B}$$

$$R_B = \frac{R_1 R_2}{R_1 + R_2 + R_3}$$

$$R_3 = \frac{R_A R_B + R_B R_C + R_A R_C}{R_A}$$

$$R_C = \frac{R_2 R_3}{R_1 + R_2 + R_3}$$